Remarks

The Examiner's office action of May 27, 2003 has been made final. This is despite a considerable number of new prior art references being cited for the first time. Applicants have accordingly submitted amendments to the claims and further argumentation and kindly request that the Examiner consider this response despite the office action being made final.

With two notable exceptions, all of the prior art references cited by the Examiner are crucially different to the present invention for the following reasons. The application is concerned with compensating for polarization mode dispersion (PMD) in optical communication systems. Because PMD is a dynamically varying effect, it is desirable to introduce a dynamically variable differential group delay between orthogonal polarization modes of an input optical signal thereby to dynamically compensate for PMD. It is known from the prior art to use a birefringent element in an optical PMD compensator and to vary some other parameter of the compensator, thereby to introduce a variable differential group delay. In contrast, the present applicants have realized that a highly effective way of introducing a variable group delay is to adjust the birefringence of the element directly. The point is that in most of the prior art cited by the Examiner, with two notable exceptions which will be discussed shortly, the birefringence of the element is static whereas in the present invention, the birefringence of the element is dynamically adjusted.

The two references in which the birefringent is dynamically adjusted are Epworth (US 6,515,778) and Chang (US 4,725,113). In Epworth, the magnitude and orientation of the birefringence of a waveguide is altered by applying mechanical stress to a chirped Bragg reflector. However, this approach is susceptible to mechanical failure and very high levels of mechanical stress must be applied to the Bragg reflector in order to achieve any significant variation in the differential group delay introduced. The present applicants have realized that by using a micro

structured waveguide, such as side hole fibre (SHF), holey fibre (HF), or photonic crystal fibre (PCF), a substantial variation in birefringence can be effected without needing to apply substantial levels of mechanical stress. The present invention is, thus, significantly more effective in compensating for substantial levels of PMD introduced by long-haul fibre links. Note that Epworth does not disclose the possibility of using micro-structured birefringent waveguides. Furthermore, use of a Bragg reflector is essential in Epworth. This has further undesirable effects in that power of the optical signal is lost as a result, and further amplification stages may be necessary, particularly in long-haul transmission systems.

Similarly, Chang does not disclose the use of micro-structured waveguides. However Chang is even less relevant for the following further reasons. Chang does not describe a PMD compensator but a polarizer or polarization controller. The object of the invention in Chang is to strip out one of the polarization modes of an input optical signal, not to introduce a variable differential group delay. Thus, although Chang does describe changing the birefringence of a fibre locally (for example at points 62 etc) this is to change the polarization of the transmitted light through phase shifting. By introducing a phase difference, the polarization of the transmitted light may be changed from linear polarisation to circular polarization and back to linear polarization which allows the polarisation of the light to be properly aligned such that the desired polarization mode may be stripped out of the input signal correctly. A key point is that the introduction of a phase shift is not suitable for compensating for PMD dispersion (as opposed to the introduction of a differential group delay). This is simply because the phase difference introduced is many orders of magnitude less then the delay required to compensate for PMD dispersion. For example with light at 1550 nanometres wavelength, the difference in orders of magnitude between the introduction of a phase difference and the introduction of an amount of differential group delay required to compensate for PMD dispersion is likely to be in the order of 10 to the power of four.

Applicants therefore request favorable reconsideration of the present application.

This response is within two months following the June 3, 2003 office action as August 3, 2003 was a Sunday.

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Respectfully submitted,

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